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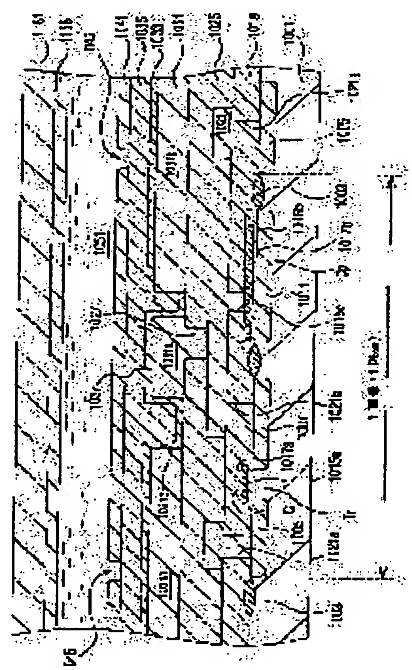
(54) REFLECTION TYPE LIQUID CRYSTAL DISPLAY DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To prevent deterioration in the picture quality of a display element due to lights leaking to a semiconductor integrated circuit.
SOLUTION: The reflection type liquid crystal display device is provided with a substrate on which a plurality of pixel areas are defined, a plurality of elements formed on the substrate including a transistor and a storage capacitor, a multi-layer wiring structure formed on the substrate on which at least two layers of inter-layer insulating films and wiring layers are repeatedly formed and reflective electrodes separated by each pixel are formed on the inter-layer insulating film in the uppermost layer, a transparent substrate faced to the substrate with the substrate and a liquid crystal layer interposed, and a common electrode formed on the transparent substrate so as to face to a reflecting electrode. At least one layer of the wiring layers forms a light shielding film covering almost the whole face of the pixel areas, and at least one of the thickness of either upper or lower inter-layer insulating films interposed between the light shielding film and the wiring layers arranged at the upper and lower parts is set to be 50 nm to 400 nm.



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CLAIMS

[Claim(s)]
[Claim 1] The substrate with which many pixel fields are demarcated, and the component of a large number which are formed in this substrate and contain a transistor and storage capacitance, The multilayer-interconnection structure where it is formed on said substrate and the reflector with which repeat formation of [more than two-layer] was carried out at least, and the interlayer insulation film and the wiring layer were separated for every pixel on the interlayer insulation film of the maximum upper layer is formed, It counters with said substrate, and it is formed on the transparence substrate which pinches a liquid crystal layer with this substrate, and said transparence substrate, and said reflector and the common electrode which counters are included. At least one layer in said wiring layer It is the reflective mold liquid crystal display whose either at least is the thickness of a before [from 50nm / 400nm] among the thickness of the up-and-down interlayer insulation film on said substrate which forms the wrap light-shielding film and is mostly pinched in the whole surface between said light-shielding film and its wiring layer arranged up and down.
[Claim 2] It is dissociated and formed on the same interlayer insulation film as the plug electrode which connects between wiring of the upper and lower sides, and this plug electrode, and at least one layer excluding said light-shielding film among said wiring layers is a reflective mold liquid crystal display according to claim 1 on said substrate which includes the whole surface for the wiring layer for wrap protection from light mostly.
[Claim 3] Said light-shielding film is a reflective mold liquid crystal display according to claim 1 or 2 which is a conductive light-shielding film.
[Claim 4] The reflective mold liquid crystal display according to claim 3 with which the contact hole which penetrates the interlayer insulation film of said upper and lower sides pinched in the meantime is formed between the wiring layers by which said light-shielding film is arranged up and down, the beer conductor which flows through between the wiring layers by which said light-shielding film is arranged up and down is formed in this contact hole, and opening currently formed in the major diameter rather than the periphery of this beer conductor on the outside of this beer conductor is formed in said light-shielding film.
[Claim 5] Said light-shielding film is a reflective mold liquid crystal display given in any 1 term to claims 1-4 connected with the metal wiring layer to which potential is kept constant in fields other than the field where the pixel field of said large number is demarcated.
[Claim 6] A reflective mold liquid crystal display given in any 1 term to claims 3-5 said whose light-shielding films are TiN monolayer.
[Claim 7] A reflective mold liquid crystal display given in any 1 term to claims 3-5 in which said light-shielding film contains the multilayers of Ti and TiN.
[Claim 8] A reflective mold liquid crystal display given in any 1 term to claims 3-5 said whose light-shielding films are film containing TiN.
[Claim 9] A reflective mold liquid crystal display given in any 1 term to claims 3-5 which are the film with which said light-shielding film contains amorphous silicon.
[Claim 10] A reflective mold liquid crystal display given in any 1 term to claims 3-5 said whose light-shielding films are film containing polycrystalline silicon.
[Claim 11] Said light-shielding film is a reflective mold liquid crystal display according to claim 1 or 2 which has insulation.
[Claim 12] The reflective mold liquid crystal display according to claim 11 with which the contact hole which penetrates the interlayer insulation film of said upper and lower sides pinched in the meantime is formed between the wiring layers by which said light-shielding film is arranged up and down, the beer conductor which flows through between the wiring layers by which said light-shielding film is arranged up and down is formed in this contact hole, and opening which contacts the periphery of this beer conductor on the outside of this beer conductor is formed in said light-shielding film.
[Claim 13] The reflective mold liquid crystal display according to claim 11 with which the contact hole which penetrates the interlayer insulation film of said upper and lower sides pinched in the meantime is formed between the wiring layers by which said light-shielding film is arranged up and down, the beer conductor which flows through between the wiring layers by which said light-shielding film is arranged up and down is formed in this contact hole, and opening currently formed in the major diameter rather than the periphery of this beer conductor on the outside of this beer conductor is formed in said light-shielding film.
[Claim 14] Said light-shielding film is a reflective mold liquid crystal display given in any 1 term to claims 11-13 which are the flattening insulator layers containing a colored inorganic pigment.
[Claim 15] Said insulating light-shielding film is a reflective mold liquid crystal display given in any 1 term to claims 11-13 which are the organic layers containing a colored inorganic pigment.

[Claim 16] A reflective mold liquid crystal display given in any 1 term to claims 1-15 in which said light-shielding film has the reflection factor of the light of within the limits from 1% to 30% in the 400 to 700nm wavelength region.
[Claim 17] Said light-shielding film doubles one layer at a time in a separate interlayer insulation film, and it is a reflective mold liquid crystal display given in any 1 term to multilayer ************** claims 1-16.
[Claim 18] A reflective mold liquid crystal display given in any 1 term to multilayer ************** claims 1-16 in the interlayer insulation film with said same light-shielding film.
[Claim 19] Said light-shielding film is a reflective mold liquid crystal display given in any 1 term to claims 1-16 currently formed in accordance with the configuration of the interlayer insulation film currently formed in the bottom of it.
[Claim 20] The substrate with which many pixel fields are demarcated, and the component of a large number which are formed in this substrate and contain a transistor and storage capacitance, The multilayer-interconnection structure where it is formed on said substrate and the reflector with which repeat formation of [more than two-layer] was carried out at least, and the interlayer insulation film and the wiring layer were separated for every pixel on the interlayer insulation film of the maximum upper layer is formed, It counters with said substrate, and it is formed on the transparence substrate which pinches a liquid crystal layer with this substrate, and said transparence substrate, and said reflector and the common electrode which counters are included. At least one layer in said wiring layer Among the thickness of the up-and-down interlayer insulation film which forms the wrap light-shielding film and is mostly pinched in the whole surface between said light-shielding film and its wiring layer arranged up and down on said substrate, at least either The reflective mold liquid crystal display which is the same as the wavelength of the incident light in a light field, or is formed in the thickness not more than it.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the reflective mold liquid crystal display used for the reflective mold liquid crystal projector which needs strong incident light especially about a reflective mold liquid crystal display.
[0002]
[Description of the Prior Art] Recently, the requests to the liquid crystal display of the projection mold which can display an image on a big screen have been mounting. If the reflective mold liquid crystal display especially reflected with a liquid crystal panel is used, since a transistor and a wiring layer can be arranged to the reflector down side, the miniaturization of a reflective mold liquid crystal projector is attained.
[0003] As for the common reflective mold liquid crystal display, a transistor and storage capacitance are formed on the substrate. The drain electrode of a transistor is connected with the reflector separated by the isolation region for every pixel field. On the reflector, only a certain distance is separated, a transparence substrate is arranged, and the transparent electrode (it is called a "common electrode" below) is formed on the inferior surface of tongue. Between a reflector and a transparent electrode, liquid crystal material is pinched and a liquid crystal layer is formed.
[0004] The light which penetrated the glass substrate and the common electrode and carried out incidence to the liquid crystal layer is reflected with a reflector. If an electrical potential difference is impressed between a reflector and a common electrode, the orientation condition of the liquid crystal molecule in a liquid crystal layer can change, and a display can be changed with the reinforcement of the reflected light.
[0005]
[Problem(s) to be Solved by the Invention] As mentioned above, a reflector is separated by the isolation region for every pixel. Although the reflector serves as a role of a gobo which prevents that the incident light other than the work as an electrode which impresses the electrical potential difference according to a picture signal to liquid crystal, and the work as a reflecting mirror for a display enters to a lower field Since a reflecting plate does not exist in an isolation region, a part of incident light which entered from the isolation region leaks in the integrated circuit currently further formed in the lower part from the clearance between wiring currently formed in the lower field.
[0006] It is between a reflector and its lower field, and the high-reflective-liquid-crystal equipment of the isolation region between reflectors (tooth space) which formed the conductive light-shielding film caudad is indicated by JP,59-121082,A. In this equipment, in the circumference of a contact hole for connecting between a reflector and other metal wiring, the conductive light-shielding film is removed so that the short circuit between a conductive light-shielding film, a reflector, or other metal wiring may not arise. Therefore, the light which passes along the part which removed the conductive light-

shielding film leaks to a substructure.
[0007] Moreover, the structure which prepared the antireflection film in the inferior surface of tongue of a reflector and the top face of a conductive light-shielding film is indicated by JP,9-171195,A and the United States patent official report No. 5978056. The light which leaks from the clearance between conductive light-shielding films declines with an antireflection film, and the probability for light to reach even a semi-conductor substrate, and luminous intensity are reduced.
[0008] However, also in this structure, in the circumference of a contact hole for connecting between a reflector and other metal wiring, the conductive light-shielding film is removed so that the short circuit between a conductive light-shielding film, a reflector, or other metal wiring may not arise. Therefore, the light which passes along the part which removed the conductive light-shielding film has a possibility of leaking to a substructure. In addition, if an antireflection film is prepared in the inferior surface of tongue of a reflector, or the top face of a conductive light-shielding film, structure will become complicated and a routing counter will also increase.
[0009] Especially, detailed-izing and densification of each pixel are needed under the request of the image display of the high brightness in high resolution like recent years. By detailed-ization of a pixel, the probability for the light which leaked from the reflector to the substructure to reach even in a semi-conductor substrate is also becoming high.
[0010] By the way, if DC electrical potential difference is continued and impressed between a reflector and a common electrode, the phenomenon called seizing of liquid crystal will happen and it will also become the cause of degradation of liquid crystal. Then, the analog voltage which made every frame (field) reverse a polarity is impressed between a reflector and a common electrode.
[0011] The relation between the analog input electrical potential difference impressed between a reflector and a common electrode at drawing 15 (A) and (B) and the pixel maintenance electrical potential difference accumulated in storage capacitance Cp is shown. In the usual reflective mold liquid crystal display, in order to prevent the above printing, it considers as the midpoint of an electrical potential difference which inputs V0 into a pixel, and the electrical potential difference is impressed to inter-electrode so that an electrical potential difference may change to every frame (field) between a plus side and a minus side focusing on V0.
[0012] As for the relation between an analog input electrical potential difference and a pixel maintenance electrical potential difference, it is ideal that an inclination becomes the straight line of 1 through a zero as the continuous line of drawing shows. However, depending on an electrical-potential-difference field, it may become nonlinear according to the problem on the property of a transistor. In this kind of liquid crystal display, it is common to use a linearity field.
[0013] However, when light leaks in an integrated circuit, light will enter the depletion-layer field of the p-n junction diode (the reverse bias is carried out) formed between the semi-conductor layers of the 2nd conductivity type formed in the semi-conductor substrate and substrate of the 1st conductivity type, for example. If light enters a depletion-layer field, an electron and an electron hole will be formed and an electron will flow in in the semi-conductor layer of the 2nd conductivity type. Since the electron number accumulated into storage capacitance changes, the relation between an analog input electrical potential difference and the pixel maintenance electrical potential difference accumulated in storage capacitance becomes the property which shifted only - alpha caudad as a broken line showed (drawing 15 (A)).
[0014] Some examples of the driving signal clock of a level shift register, a HSRj output, and the video input signal Vin are shown in drawing 15 (B). The Video signal is on + and - side for every frame focusing on V0. Both the effects of optical leak work as a direction which applies an electrical potential difference to - side, and they are shifted as an optical exposure progresses (as time amount progresses). The signal level of **** of drawing 15 (B) is shifted to a minus side like a broken line by optical leak to the case (continuous line) where there is no optical leak.
[0015] If such a shift arises, since it will become a field flicker, it leads to degradation of image quality.
[0016] This invention aims at solving the above-mentioned trouble resulting from a leakage lump of light.
[0017]
[Means for Solving the Problem] The substrate with which many pixel fields are demarcated according to one viewpoint of this invention, It is formed on the component of a large number which are formed in this substrate and contain a transistor and storage capacitance, and said substrate, and repeat formation of [more than two-layer] is carried out for an interlayer insulation film and a wiring layer at least. The multilayer-interconnection structure where the reflector separated for every pixel is formed on the interlayer insulation film of the maximum upper layer, It counters with said substrate, and it is formed on the transparence substrate which pinches a liquid crystal layer with this substrate, and said transparence substrate, and said reflector and the common electrode which counters are included. At least one layer in said wiring layer The reflective mold liquid crystal display whose either is the thickness of a before [from 50nm / 400nm] is offered at least among the thickness of the interlayer insulation film of the upper and lower sides to said pixel field which are mostly formed by the wrap light-shielding film in the whole surface, and are pinched between said light-shielding film and its wiring layer arranged up and down.
[0018] According to the above-mentioned reflective mold liquid crystal display, the optical path which light spreads is formed, reflecting between both multiply between a conductive light-shielding film, its upper layer, or the lower layer metal wiring film. The light which progresses the inside of an optical path declines by piling up a multiple echo, and by the time it arrives at a lower field, it can weaken.
[0019]
[Embodiment of the Invention] It is the sectional view showing the structure of a reflective mold liquid crystal display in drawing 1 .
[0020] The MOS mold field-effect transistor (MOSFET) Tr and storage capacitance Cp are formed according to the semi-conductor process described below on the p-type silicon semi-conductor substrate (a "semi-conductor substrate" is called hereafter.) 1001. MOSFET:Tr and storage capacitance Cp — LOCOS (Local Oxidation of Silicon) — the component detached core 1003 formed of law separates.

[0021] n mold impurity layer 1011 which becomes with the retention volume formation section is formed in behind at the semi-conductor substrate 1001. Subsequently, on the semi-conductor substrate 1001, the thin thermal oxidation film 1015 (1015a and 1015b) is formed, and, subsequently polycrystalline silicon layer 1017a and polycrystalline silicon layer 1017b are formed. Polycrystalline silicon layer 1017b is formed on n mold impurity layer 1011.
[0022] Polycrystalline silicon layer 1017a constitutes the gate electrode G of a MOS transistor. n mold impurity layer 1005 and n mold impurity layer 1007 are formed in self align to the gate electrode G. n mold impurity layer 1005 and n mold impurity layer 1007 serve as the source S of MOS transistor Tr, and Drain D, respectively. Storage capacitance Cp is formed of n mold impurity layer 1011, thermal oxidation film 1015b, and polycrystalline silicon electrode 1017b.
[0023] On the substrate with which MOS transistor Tr and storage capacitance Cp were formed, the interlayer insulation films 1018, 1025, 1033, and 1035 from the 1st to the 4th are formed. On the 1st interlayer insulation film 1018, the 2nd-layer wiring 1031 is formed on the 2nd interlayer insulation film 1025, and the 3rd-layer wiring 1041 is formed for the 1st-layer wiring 1023 on the 4th interlayer insulation film 1035. The drain D of MOS transistor Tr and polycrystalline silicon electrode 1017b of storage capacitance Cp are connected electrically. The 3rd-layer wiring 1041 forms a pixel electrode (reflector RE). Reflector RE has covered the field for about 1 pixel, and is separated by the isolation region 1045 for every pixel.
[0024] A transparent electrode 1155 is formed in the inferior surface of tongue of the transparence glass substrate 1161. On Reflector RE, only a certain distance is separated and the transparence glass substrate 1161 is arranged. Between Reflector RE and a transparent electrode 1155, the liquid crystal material 1051 is pinched and a liquid crystal layer is formed.
[0025] The contact hole which penetrates it is suitably established in the above-mentioned insulator layer between each class. For example, the drain D of Transistor Tr is connected with Reflector RE by wiring 1023, wiring 1031, and wiring 1041 through contact hole 1021b formed in the interlayer insulation film 1018 of the 1st layer, the contact hole 1027 formed in the interlayer insulation film 1025 of the 2nd layer, and the 3rd and the interlayer insulation film 1033 of the 4th layer and the contact hole 1037 formed in 1035. 1st wiring section 1031a, 1st wiring section 1031a, and pore 1031c for connecting wiring 1023 and a reflector 1041 dissociate, and wiring 1031 contains protection-from-light section 1031b of a substrate currently mostly formed in the whole surface.
[0026] The light which penetrated the glass substrate 1161 and the common electrode 1155, and carried out incidence to the liquid crystal layer is reflected with Reflector RE. If an electrical potential difference is impressed between Reflector RE and the common electrode 1155, the orientation condition of the liquid crystal molecule in a liquid crystal layer can change, and a display can be changed with the reinforcement of the reflected light.
[0027] In the above-mentioned structure, Reflector RE is separated by the isolation region 1045 for every pixel. Although Reflector RE serves as the reflecting plate which prevents that incident light enters even a lower field, a reflecting plate does not exist in an isolation region 1045. A part of incident light which entered from the isolation region 1045 leaks in the integrated circuit currently further formed in the lower part from the clearance between wiring currently formed in the lower field. Since protection-from-light section 1031b is formed also in the bottom of an isolation region 1045, it reduces the probability for the light which leaked from the isolation region 1045 and was crowded to arrive even at a lower field.
[0028] Light will be leaked and crowded since it is necessary to prepare pore 1031c for separating protection-from-light section 1031b from 1st wiring section 1031a electrically in fact also between 1st wiring section 1031a and protection-from-light section 1031b.
[0029] If the protection-from-light layer between a reflector and a wiring layer, between wiring layers, and between a wiring layer and a semi-conductor substrate constituted only from an ingredient with a low reflection factor at least by either is prepared, penetration of the light to the substructure containing the semi-conductor substrate by the multiple echo can be controlled. It is still better if a fixed limit is prepared in the thickness of the interlayer insulation film currently formed between the protection-from-light layer, the wiring layer, or the electrode.
[0030] Usually, in the semiconductor integrated circuit manufacturing technology containing liquid crystal equipment, the thickness of the interlayer insulation film currently formed between metal layers is about 1 micrometer. The thickness of 1 micrometer is the thickness which the light which leaked between interlayer insulation films can spread easily.
[0031] Coming to have optical intensity distribution which produce the mode of propagation which is computed by a certain boundary condition on an electromagnetism, have the part of high reinforcement in the thickness direction of an interlayer insulation film, and lengthen the skirt focusing on the part of the high reinforcement in the following bibliography, if an interlayer insulation film becomes below a certain amount of thickness is explained.
[0032] Bibliography 1 :P .KTien"Light Wave in Thin Films and Integrated Optics" Appl.Optics Ten (1971) p2395-2413
Bibliography 2: T.Tamir"Integrated Optics" Springer verlag, New York, 1975
Bibliography 3 :P .KTien and R Ulrich "Theoryof Prism-Film Coupler and Thin-FilmLight Guides", J.Optical Soc.America60 (1970) p1325-1337
It depends for the above-mentioned boundary condition on the wavelength of the target light, the refractive index of an interlayer insulation film, and the refractive index of the layer prepared up and down. However, in the case of the interlayer insulation film mainly used in the production process of the semiconductor integrated circuit containing a liquid crystal display, propagation of the light according to the above-mentioned mode of propagation begins from about 2 times [of the wavelength of light] thickness. If it becomes thickness comparable as the wavelength of light especially, the above-mentioned optical mode of propagation will become dominant. In a reflective mold liquid crystal display, incident light has a light field, i.e., the wavelength field between 400nm and 700nm.
[0033] The artificer thought that the above-mentioned optical mode of propagation which passes along the interlayer insulation film between the wiring layers or electrodes which are formed in a light-shielding film and the bottom of it could be controlled, and penetration of the light to the field below it could be controlled, when making into the thickness below the operating wavelength in the above-mentioned light field thickness of the interlayer insulation film between the wiring layers or electrodes which are formed in a light-shielding film and the bottom of it.

[0034] If thickness of the interlayer insulation film between the wiring layers or electrodes which are formed in a light-shielding film and the bottom of it is especially made below into the thickness equivalent to the minimum by the side of the short wavelength in a light field, i.e., the thickness of 400nm or less, penetration of the light to the lower field by the above-mentioned optical mode of propagation can be reduced sharply. In addition, as for the thickness of an interlayer insulation film, it is desirable that it is 50nm or more. The coverage on the wiring layer arranged up and down on both sides of an interlayer insulation film as thickness is 50nm or less, or an electrode worsens, and a problem arises for the insulation between both.
[0035] What is necessary is just to use Ti film, the TiN film, or Si film as a protection-from-light ingredient of a low reflection factor, for example. If the film which makes thickness of the interlayer insulation film between the wiring layers or electrodes which are formed in a light-shielding film and the bottom of it within the limits of the above, and contains a low reflection factor ingredient as a light-shielding film is used, it can control further that light reaches to a semi-conductor substrate.
[0036] For example, if a reflection factor is controlled at least in the wavelength field between 400nm and 700nm on the top face of an interlayer insulation film, or the inferior surface of tongue, the luminous intensity which entered from the isolation region of a reflector can be attenuated to 1/100,000 to about 1/200,000 by about dozens of times of multiple echoes. Based on the above consideration, the reflective mold liquid crystal display by the gestalt of operation of this invention is explained below.
[0037] First, from drawing 2 to drawing 7 is referred to and explained about the reflective mold liquid crystal display by the gestalt of operation of the 1st of this invention.
[0038] Drawing 2 is the representative circuit schematic of a reflective mold liquid crystal display. Drawing 3 is the circuit diagram showing the detail of the configuration of an address circuit among the circuit diagrams shown in drawing 2 . Drawing 4 to drawing 6 is the top view of a reflective mold liquid crystal display. Drawing 7 (A) is the sectional view of a reflective mold liquid crystal display, and is the VIIa-VIIa' line sectional view of the top view shown by drawing 6 from drawing 4 . Drawing 7 (B) is the schematic diagram showing the course of the leakage light in drawing 1 and the high-reflective-liquid-crystal equipment of drawing 7 (A).
[0039] As shown in drawing 2 , the reflective mold liquid crystal display A has the direction address circuit Y of Y for specifying the address of the direction address circuit X of X for specifying the pixel PIX of a large number located in a line in the line writing direction and the direction of a train, and the address of a line writing direction, and the direction of a train. Pixel PIX has Transistor Tr, liquid crystal cell EC, and storage capacitance Cp. From the direction address circuit Y of Y, two or more scanning lines Yi (i= 1, 2, 3 --) are prolonged in the line writing direction. From the direction address circuit X of X, two or more signal lines Xj are prolonged in the direction of a train.
[0040] The source electrode S of the transistor Tr contained in Pixel PIX is connected to the signal line Xj. The source electrode S of the transistor Tr of one train is connected with one signal line Xj in common. The gate electrode G is connected to the scanning line Yi. The gate electrode of the transistor Tr of one line is connected with the one scanning line Yi in common. The drain electrode D of Transistor Tr is connected with the common electrode Com through storage capacitance Cp. In addition, the drain electrode D is connected with the reflector (pixel electrode) which forms liquid crystal cell EC.
[0041] As shown in drawing 3 , as for the direction address circuit Y of Y, one step of output of a perpendicular shift register corresponds to the one scanning line Yi. The output signal of the perpendicular shift register VSR is inputted into the input terminal Vin1 of the level shift circuit LS 1 constituted by the CMOS inverter circuit. V0-AP is supplied and an output level shifts the power source of LS1 from a VSR output level to the supply level of AP. V0-AP is supplied and, as for the power source of LS1, the scanning line Yi is prolonged from the output terminal of a VSR output level. The scanning line Yi is connected to gate terminal G of the pixel transistor Tr as mentioned above. As for the direction address circuit X of X, one step of output of the level shift register HSR corresponds to each train. V0-AP is supplied and an output level shifts the power source of LS2 from a VSR output level to the supply level of AP.
[0042] The output of the level shift register HSR is inputted into the analog switch circuit ANS through inverter circuit LS2. Two transistors of n mold MOS transistor and p mold MOS transistor are connected to juxtaposition, and the analog switch circuit ANS constitutes the pass transistor. It switches whether the analog switch circuit ANS lets video signal Video-in pass to a signal line Xj. The signal line Xj is connected to the source terminal S of the transistor Tr in a pixel as mentioned above.
[0043] In addition, the analog input electrical potential difference shown in above-mentioned drawing 15 is the input voltage from Video-in, and a pixel maintenance electrical potential difference is an electrical potential difference expressed with ****.

[0044] The reflective mold liquid crystal display which has the above-mentioned configuration carries out the following actuation.
[0045] If a signal line Xj is chosen by the direction address circuit of X, the analog switch circuit ANS by which the direction selection of a train was made will be turned on, and the picture signal inputted into Video-in will be led to the direction signal line Xj of a train through the analog switch circuit ANS. When the gate G of the pixel transistor Tr connected with the scanning line Yi chosen by the direction address circuit of Y at this time is turned on, the retention volume (storage capacitance) Cp connected to the drain D of the corresponding pixel (the X-Y address was carried out) PIXji is charged by the charge according to the amount of signals. At this time, the electrical potential difference of retention volume Cp is impressed also to a reflector (pixel electrode) at coincidence.
[0046] The potential of a reflector is held until the following selection signal is impressed to the same scanning line Yi with the charge accumulated in storage capacitance Cp, even if the selection signal of the scanning line Yi is set to Low. In the meantime, the potential difference between a reflector and a common electrode is impressed to the liquid crystal layer of liquid crystal cell EC. Since the light transmittance of liquid crystal changes, the outgoing radiation light reflected by the reflector can be modulated by controlling the potential difference by the picture signal of a signal line Xj.
[0047] By making into an ON state all the pixel transistors Tr that energize a selection signal to the scanning line Yi, and are

specifically connected to Yi, and writing in a picture signal through a signal line Xj to each storage capacitance Cp connected to the transistor Tr turned on, scanning in the direction of a train, incident light can be modulated per pixel and the desired reflected light can be obtained.

[0048] Drawing 4 to drawing 6 is the top view of a reflective mold liquid crystal display. Drawing 4 is drawing having shown the field in which the impurity layer mainly formed in the semi-conductor substrate and a polycrystalline silicon layer are formed. Drawing 5 is drawing having mainly shown the field in which the wiring layers and contact holes from the 1st to the 3rd are formed. Drawing 6 is drawing having shown the field in which a light-shielding film is mainly formed. Drawing 7 (A) is the sectional view of a reflective mold liquid crystal display.

[0049] The MOS mold field-effect transistor (MOSFET) Tr and storage capacitance Cp are formed according to a semi-conductor process on the p-type silicon semi-conductor substrate (a "semi-conductor substrate" is called hereafter.) 1. MOSFET:Tr and storage capacitance Cp -- LOCOS (Local Oxidation of Silicon) -- the component detached core 3 formed of law separates.

[0050] n mold impurity layer 11 is formed in the semi-conductor substrate 1. Subsequently, the thin thermal oxidation film 15 (15a and 15b) is formed on the semi-conductor substrate 1, and, subsequently to a longitudinal direction (line writing direction), prolonged polycrystalline silicon layer 17a and polycrystalline silicon layer 17b in a pixel field are formed. Polycrystalline silicon layer 17b is formed on n mold impurity layer 11.

[0051] Polycrystalline silicon layer 17a constitutes the gate electrode G of a MOS transistor. In case the scanning line Yi (drawing 2 R> 2) forms the gate electrode G, wiring is formed with the polycrystalline silicon of the same layer, and it is connected to the output section of LSI (drawing 3). n mold impurity layer 5 and n mold impurity layer 7 are formed in self align to the gate electrode G. n mold impurity layer 5 and n mold impurity layer 7 serve as the source S of MOS transistor Tr, and Drain D, respectively. Storage capacitance Cp is formed of n mold impurity layer 11, thermal oxidation film 15b, and polycrystalline silicon electrode 17b. The drain D of MOS transistor Tr and polycrystalline silicon electrode 17b of storage capacitance Cp are connected electrically.

[0052] An interlayer insulation film is formed on the substrate with which MOS transistor Tr and storage capacitance Cp were formed. For example, the interlayer insulation film (the 1st interlayer insulation film) 18 of the 1st layer is formed with the silicon oxide film using an ordinary pressure CVD method. The openings 21a and 21b which expose source [of Transistor Tr] S and Drain D top to the 1st interlayer insulation film 18 are formed. At this time, opening 21c is formed also on polycrystalline silicon electrode 17b which forms storage capacitance Cp. Moreover for example, the sputtering method is used and the 1st wiring layer (1M) 23 is formed.

[0053] The 1st wiring layer 23 contains 1st 1st wiring layer 23a and 2nd 1st wiring layer 23b. 1st 1st wiring layer 23a connects between each pixel field to the source field S of Transistor Tr through opening 21a while being prolonged mostly perpendicularly (the direction of a train). 1st 1st wiring layer 23a and 2nd 1st wiring layer 23b are separated. 2nd 1st wiring layer 23b is connected with polycrystalline silicon layer 17b which forms the up electrode of storage capacitance Cp through opening 21c while connecting with the drain field D of Transistor Tr through opening 21b. The up electrode of storage capacitance Cp is also connected to the drain of Transistor Tr. In addition, drawing 7 (A) supports the cutting plane containing opening 21c.

[0054] For example, the interlayer insulation film (the 2nd interlayer insulation film) 25 of the 2nd layer is formed with silicon oxide, using a plasma-CVD method etc. It is in the 2nd interlayer insulation film 25, and opening 27 is formed in the position on 2nd 1st wiring layer 23b.

[0055] Next, for example, the 2nd wiring layer (2M) 31 is formed using the sputtering method. The 2nd wiring layer 31 contains 1st 2nd wiring layer 31a and 2nd 2nd wiring layer 31b.

[0056] The 1st and 2nd wiring layers [2nd] 31a and 31b are separated by the band-like isolation region 30 which has a configuration band-like with an abbreviation rectangle. 1st 2nd wiring layer 31a is formed inside the band-like isolation region 30, and is connected with 2nd 1st wiring layer 23b through opening 27. 2nd 2nd wiring layer 31b is the outside of the band-like isolation region 30, and includes many pixel fields -- it is mostly formed all over a substrate. 1st 2nd wiring layer 31a has the function of the plug for connecting 2nd 1st wiring layer 23b, up wiring mentioned later, or a pixel electrode.

[0057] Subsequently, the interlayer insulation film (the 3rd interlayer insulation film) 35 of the 3rd layer is formed, for example using a plasma-CVD method etc. For example, on the 3rd interlayer insulation film 35, SOG etc. is used and the interlayer insulation film (the 4th interlayer insulation film) 37 of the 4th layer is formed. The front face of the 4th interlayer insulation film 37 becomes flat.

[0058] Thickness of the sum total of the 3rd interlayer insulation film 35 and the 4th interlayer insulation film 37 on the 2nd wiring (2M) 31 (31a, 31b) which were formed with the silicon oxide film is set to 400nm or less.

[0059] For example, 50nm laminating of 20nm and the TiN layer is carried out for Ti layer using the sputtering method etc. This Ti/TiN film functions as a conductive light-shielding film 38. In addition, the adhesion of the TiN film and the 4th interlayer insulation film 37 improves by forming Ti layer between an interlayer insulation film 37 and the TiN film.

[0060] Subsequently, opening 38a which connotes the field which forms a contact hole 40 in behind among the conductive light-shielding films 38 is formed. an excluding [the conductive light-shielding film 38] opening substrate top -- almost -- the whole surface -- a wrap. For example, the insulator layer and SOG which are formed with silicon nitride on the conductive light-shielding film 38 using a plasma-CVD method etc. are used together, and the 5th interlayer insulation film 39 is formed. A field is removed in part and the contact hole 40 of the 5th interlayer insulation film 39 and the 4th and 3rd interlayer insulation films 37 and 35 which exposes the top face of 1st 2nd wiring 31a is formed. For example, the wiring layer (the 3rd wiring) 41 of the 3rd layer is formed using the sputtering method etc. The wiring layer currently embedded in the contact hole 40 is called a beer conductor. The beer conductor is separated from the conductive light-shielding film 38. The 3rd wiring layer 41 is connected with 2nd wiring 31a through a contact hole 40. The isolation region 43 which separates the 3rd wiring layer 41 for every pixel is formed. The 3rd wiring layer can be operated as a reflector RE. Reflector RE is connected to the

drain of Transistor Tr, and the polycrystalline silicon electrode of the pixel retention volume Cp through opening 40, 1st 2nd wiring layer 31a, opening 27, and 2nd 1st wiring layer 23b.
[0061] The common electrode 55 is formed with transparent electrodes, such as ITO (Indium Tin Oxide), all over the 1 front-face side of a glass substrate 61. Subsequently, the sealant which is not illustrated is arranged to the periphery of a substrate, and a glass substrate 61 and a substrate 1 are arranged so that only Reflector RE and a certain distance may be separated and Reflector RE and the common electrode 55 may counter. What is necessary is just to use for example, gap control, in order to specify the gap between substrates. Liquid crystal material is poured in between Reflector RE and the common electrode 55, and a reflective mold liquid crystal display is completed.
[0062] In the above-mentioned reflective mold liquid crystal display, the conductive light-shielding film 38 top is formed on the 4th and 3rd interlayer insulation films 37 and 35, and the 5th interlayer insulation film 39 is formed on it. The sum total of the thickness of the 3rd and 4th interlayer insulation films 35 and 37 under the conductive light-shielding film 38 is thin with 400nm or less. In addition, as for the thickness of an interlayer insulation film, it is desirable that it is 50nm or more as mentioned above. The coverage on the wiring layer arranged up and down on both sides of an interlayer insulation film as thickness is 50nm or less, or an electrode worsens, and a problem arises for the insulation between both.
[0063] Drawing 7 (B) is the sectional view showing the structure which omitted the liquid crystal layer and the glass substrate containing a common electrode among the structures of drawing 7 (A). In drawing 7 (B), the path when light is leaked and crowded from the isolation region 43 which exists in the clearance between the adjoining reflectors RE is shown typically. The continuous line shows the optical path at the time of assuming that the conductive light-shielding film 38 does not exist in the same structure as drawing 7 (A). When the conductive light-shielding film 38 is not formed, the light which leaked from the isolation region 43 and was crowded spreads the inside of an interlayer insulation film, repeating reflection between the rear face of Reflector RE, and the top face of the 2nd wiring 31.
[0064] Subsequently light leaks in the 2nd lower interlayer insulation film 25 further through the band-like isolation region 30 during wiring (opening). The inside of an interlayer insulation film is spread light repeating reflection in the 2nd interlayer insulation film 25 between the inferior surface of tongue of the 2nd wiring 31, and the top face of the 1st wiring 23. Subsequently light leaks in the 1st lower interlayer insulation film 18 further through the opening 24 during wiring. The inside of an interlayer insulation film is spread light repeating reflection in the 1st interlayer insulation film 18 between the inferior surface of tongue of 1st wiring 23a or 23b, and the top face of polycrystalline silicon layer 17b. The light which leaked from the isolation region and was crowded reaches Transistor Tr or retention volume Cp currently finally formed in the substrate 1. In reflecting in a metal layer, light declines, but since a metal layer and especially the reflection factor of aluminum electrode usually used are high, it will have a bad influence on properties, such as Transistor Tr.
[0065] On the other hand, to drawing 7 (B), when the conductive light-shielding film 38 is formed between the 4th interlayer insulation film 37 and the 5th interlayer insulation film 39, as a broken line shows, as for light, light repeats reflection between the inferior surface of tongue of Reflector RE, and the top face of the conductive light-shielding film 38. Even if light is leaked and crowded from clearance 38a of the conductive light-shielding film 38, light will repeat reflection further in the interlayer insulation film 35 between the inferior surface of tongue of the conductive light-shielding film 38, and the top face of the 2nd wiring 31, and 37. There are many counts of reflection of the direction in case the conductive light-shielding film is formed by the case where it is not formed with the case where the conductive light-shielding film is formed so that clearly from drawing 7 (B). In addition, if an ingredient with the reflection factor of light low (an absorption coefficient is high) as a conductive light-shielding film is used, light will also reduce the probability even for a substrate to reach. Furthermore, if thickness of the interlayer insulation film between the wiring layers or electrodes which are formed in the bottom of a conductive light-shielding film is made below into the thickness equivalent to the minimum by the side of the short wavelength in the above-mentioned light field, i.e., the thickness of 400nm or less, the above-mentioned optical mode of propagation which passes along the interlayer insulation film between the wiring layers or electrodes which are formed in a light-shielding film and the bottom of it can be controlled, and the propagation of the light by the above-mentioned reflection itself will stop being able to happen easily. As the result, penetration of the light to the field below it can be controlled sharply.
[0066] In addition, it is good as for 400nm or less in the thickness of the interlayer insulation film 39 which replaces with the bottom of a conductive light-shielding film, and is formed on the conductive light-shielding film 38. In addition, if thickness of the interlayer insulation films 35 and 37 under the conductive light-shielding film 38 is also made thin to the same extent, it can also control further that light spreads the inside of an interlayer insulation film.
[0067] the ingredient for conductive light-shielding films -- carrying out -- various ingredients can be used. The ingredient which can maintain a low reflection factor, for example, 30% or less of reflection factor, among 700nm from 400nm of wavelength fields especially is desirable.
[0068] If a reflection factor is controlled to 30% or less on a top face or the inferior surface of tongue at least in the wavelength field between 400nm and 700nm, the luminous intensity which entered from the isolation region of a reflector will be decreased to 1/100,000 to about 1/200,000 by 10 times to about 11 times of multiple echoes.
[0069] In addition, when not making a conductive light-shielding film so thick, the transmitted light will also exist. Even in such a case, the probability for light to reach a substrate compared with the case where a conductive light-shielding film is not prepared is reduced sharply. Especially the probability for light to reach even to a substrate since it is formed in the location where the 2nd wiring layer 31 and the conductive light-shielding film 38 were formed in the location on a substrate where it is formed and each both slight opening shifted from the isolation region of a reflector in so that the whole surface might be covered mostly, and both openings shifted as shown in drawing 5 and drawing 6 becomes very low.
[0070] As explained above, according to the reflective mold liquid crystal display by the gestalt of this operation, the light between 700nm can be sharply attenuated from the light which leaked from the isolation region for separating a reflector, especially 400nm of wavelength fields, by the time even a lower field, especially a substrate reach.
[0071] Therefore, the effect of the light given to the transistor currently formed in the substrate can be reduced sharply, and

degradation of the liquid crystal in the reflective mold liquid crystal display resulting from the operating point offsetting can be prevented. Degradation of the display quality of a reflective mold liquid crystal display can be prevented.
[0072] In addition, in the reflective mold liquid crystal display by the gestalt of this operation, although the film containing TiN or it was used as a light-shielding film, the amorphous silicon film, the polycrystalline silicon film, etc. may be used, for example. The amorphous silicon film, the polycrystalline silicon film of the reflection factor of the light which has the wavelength of 300 to 700nm, etc. are low. Therefore, the light spread by the multiple echo can be absorbed efficiently, and light is decreased effectively.
[0073] Next, the 1st modification of the reflective mold liquid crystal display by the gestalt of the 1st operation is explained with reference to drawing 8 .
[0074] As shown in drawing 8 , the reflective mold liquid crystal display by the 1st modification differs from the reflective mold liquid crystal display by the gestalt of implementation of the above 1st in the point that the conductive light-shielding film 38 currently formed between the interlayer insulation film 35 and the interlayer insulation film 39 is formed in accordance with the configuration of the band-like isolation region (opening) 30 currently formed in the 2nd wiring 31.
[0075] Also in the reflective mold liquid crystal display by this modification, thickness of an interlayer insulation film 35 on the 2nd wiring (2M) 31 is set to 400nm or less. The conductive light-shielding film 38 is formed by thickness from which a reflection factor becomes 30% or less in a light field (from 400nm to 700nm) about a TiN layer, for example, the thickness of about 50nm, for example, using the sputtering method etc. In order to raise the adhesion of a TiN layer and an interlayer insulation film 35, Ti may be inserted between a TiN layer and an interlayer insulation film 35. As thickness of Ti, the thickness of a before [from 30nm / 60nm] has the desirable thickness of 30nm or less as thickness of a TiN layer.
[0076] Therefore, it can be made to decrease sharply by the time the light between 700nm reaches even to a lower field, especially a substrate from the light which leaked from the isolation region for separating a reflector like the case of the reflective mold liquid crystal display by the gestalt of implementation of the above 1st, especially 400nm of wavelength fields. The effect of the light given to the transistor currently formed in the substrate can be reduced sharply, and degradation of the liquid crystal in the reflective mold liquid crystal display resulting from the operating point offsetting can be prevented. In addition, in the reflective mold liquid crystal display by this modification, a conductive light-shielding film is prepared in accordance with the configuration of the 2nd wiring [directly under] 31 and an interlayer insulation film 35 through an interlayer insulation film. Therefore, the light which can leak, and can lengthen the optical path length of the crowded light, and leaked from what (irregularity exists) its an optical path is not straight can be attenuated more efficiently.
[0077] Next, the 2nd modification of the reflective mold liquid crystal display by the gestalt of the 1st operation is explained with reference to drawing 9 .
[0078] As shown in drawing 9 , in the reflective mold liquid crystal display by the 2nd modification, the lower layer conductivity light-shielding film 71 is formed between the 2nd interlayer insulation film 25 and the 3rd interlayer insulation film 73. Flattening of the 2nd interlayer insulation film 25 is carried out by the etchback method. The conductive light-shielding film 71 containing TiN forms on the 2nd interlayer insulation film 25 by which flattening was carried out. The lower layer conductivity light-shielding film 71 carries out the laminating of the TiN layer by the thickness of 50nm for example, using the sputtering method etc. The 3rd interlayer insulation film 73 is formed on the lower layer conductivity light-shielding film 71. The 2nd wiring layer 31 is formed on the 3rd interlayer insulation film 73. Thickness of the 2nd interlayer insulation film 25 and the 3rd interlayer insulation film 73 is set to 400nm or less.
[0079] Subsequently, the 3rd wiring layer 31 is formed on the 3rd interlayer insulation film 73. The 4th interlayer insulation film 35 is formed for example, by the plasma-CVD method on the 3rd wiring layer 31, and, subsequently the 5th interlayer insulation film 39 is formed using SOG. By using SOG, the front face of the 5th interlayer insulation film 39 becomes flat. On the 5th interlayer insulation film, the 3rd wiring 41 is formed for example, by the sputtering method etc., an isolation region 43 is formed for every pixel, and Reflector RE is formed.
[0080] The reflection factor of a conductive light-shielding film is set to a light field (from 400nm to 700nm). For example, if it is made to become 30% or less, it will also set in the 2nd modification like the case of the reflective mold liquid crystal display by the gestalt of implementation of the above 1st. It can be made to decrease sharply by the time the light between 700nm reaches even to a lower field, especially a substrate from the light which leaked from the isolation region for separating a reflector, especially 400nm of wavelength fields.
[0081] Therefore, the effect of the light given to the transistor currently formed in the substrate can be reduced sharply, and degradation of the liquid crystal in the reflective mold liquid crystal display resulting from the operating point offsetting can be prevented.
[0082] Next, the reflective mold liquid crystal display by the 3rd modification is explained with reference to drawing 10 .
[0083] As shown in drawing 10 , in the reflective mold liquid crystal display by the 3rd modification, it has both the lower layer conductive light-shielding film 71 and the upper conductive light-shielding film 38. Each thickness of the interlayer insulation film of the upper and lower sides of the lower layer conductive light-shielding film 71 and the interlayer insulation film with which the upper conductive light-shielding film 38 is formed up and down is 400nm or less. By the time even a lower field, especially a substrate reach the light between 700nm from the light which leaked in the reflective mold liquid crystal display according to this modification, and was crowded, especially 400nm of wavelength fields, it can be made to decrease sharply by providing a two-layer conductive light-shielding film.
[0084] Therefore, the effect of the light given to the transistor currently formed in the substrate can be reduced sharply, and degradation of the liquid crystal in the reflective mold liquid crystal display resulting from the operating point offsetting can be prevented.
[0085] In addition, in the reflective mold liquid crystal display by the above-mentioned modification, although the two-layer conductive light-shielding film was used, the conductive light-shielding film of three or more layers may be used. The conductive light-shielding film using a different presentation and a different ingredient is sufficient. The conductive light-

shielding film more than one layer or two-layer may be prepared in the same interlayer insulation film.
[0086] Below, the potential of a conductive light-shielding film is considered.
[0087] Generally, the conductive light-shielding film prepared in a reflective mold liquid crystal display is in the condition of floating electrically. In the semiconductor integrated circuit containing a reflective mold liquid crystal display, an electric noise may occur at the time of actuation of the time of turning on and off of a power source, a circuit, or a liquid crystal cell etc. When a conductive light-shielding film is in floating, it originates in a noise and a charge may be accumulated in a conductive light-shielding film through an interlayer insulation film. Since the obstruction height of the interlayer insulation film surrounding the perimeter of a conductive light-shielding film is high when a charge is accumulated into a conductive light-shielding film, it becomes impossible to return a conductive light-shielding film to a condition [****] electrically by discharge.

[0088] In addition, induction of the charge is carried out into an interlayer insulation film by the internal photoelectric effect by incident light with strong short wavelength, and also when this charge is moved and fixed to a light-shielding film, a case where originate in a noise and it is charged, and same result are brought.
[0089] Then, it is desirable to make the path which misses the charge accumulated in a conductive light-shielding film.
[0090] The reflective mold liquid crystal display by the gestalt of operation of the 2nd of this invention is explained with reference to drawing 11 .
[0091] Drawing 11 is drawing corresponding to drawing 7 (A) of the gestalt of the 1st operation. Furthermore, boundary regions other than a pixel field are also shown. Circumference circuits, such as an address circuit shown in drawing 1 , are formed in the boundary region. If a circumference circuit field is covered by the light-shielding film, the effect of the light given to a circumference circuit can be reduced, and a circumference circuit can be operated to stability. The conductive light-shielding film 38 is prolonged even to fields other than a pixel field (boundary region), and is electrically connected with the 2nd wiring 31 in the boundary region through the opening 82 which penetrates interlayer insulation films 35 and 37. The 2nd wiring layer 31 is maintained at fixed potential. For example, it may be maintained at touch-down potential.
[0092] The charge accumulated into the conductive light-shielding film 38 can be missed outside by connecting the conductive light-shielding film 38 with the wiring 31 of a boundary region electrically. A conductive light-shielding film can be kept electric in the condition [****].
[0093] Next, the 1st modification of the reflective mold liquid crystal display by the gestalt of operation of the 2nd of this invention is explained with reference to drawing 12 .
[0094] Drawing 12 is drawing corresponding to drawing 9 of the gestalt of the 1st operation. Furthermore, boundary regions other than a pixel field are also shown. The conductive light-shielding film 71 is prolonged even to fields other than a pixel field (boundary region), and is electrically connected with the 1st wiring 23 into the interlayer insulation film 25 in the boundary region.
[0095] When the conductive light-shielding film 71 connects with the 1st wiring 23 of a boundary region electrically, the charge accumulated into the conductive light-shielding film 71 can be missed outside. Therefore, a conductive light-shielding film can be kept electric in the condition [****]. Moreover, circuit actuation can be carried out to stability by covering the circumference circuit currently formed in the boundary region.
[0096] Next, the 2nd modification of the reflective mold liquid crystal display by the gestalt of operation of the 2nd of this invention is explained with reference to drawing 13 .
[0097] Drawing 13 is drawing corresponding to drawing 10 of the gestalt of the 1st operation. Furthermore, boundary regions other than a pixel field are also shown. The conductive light-shielding film 38 and the conductive light-shielding film 71 are prolonged even to fields other than a pixel field (boundary region), and are electrically connected with the 2nd wiring 31 or the 1st wiring 23 into the interlayer insulation film (37, 35, or 25) in the boundary region. In addition, the liquid crystal layer is not formed in the boundary region in this drawing.
[0098] When the conductive light-shielding film 38 and the conductive light-shielding film 71 connect with the wiring 31 of the 2nd of a boundary region, or the 1st wiring 23 electrically, the charge accumulated into the conductive light-shielding film 38 and the conductive light-shielding film 71 can be missed outside. Therefore, a conductive light-shielding film can be maintained at a condition [****].
[0099] Next, the reflective mold liquid crystal display by the gestalt of operation of the 3rd of this invention is explained with reference to drawing 14 . The reflective mold liquid crystal display shown in drawing 14 has the same structure as the reflective mold liquid crystal display fundamentally shown in drawing 7 (A). However, light-shielding film 38' shown in drawing 14 has insulation to the light-shielding film 38 of drawing 7 (A) having conductivity. SOG containing a colored pigment may be used as insulating light-shielding film 38', and the organic layer containing a colored inorganic pigment may be used. For example, it is formed of the resin layer containing carbon black. In addition, when using an insulating light-shielding film, the location of the opening edge of the opening 40 of an interlayer insulation film 35, an interlayer insulation film 37, and an interlayer insulation film 39 and open end 38b of insulating light-shielding film 38' may be in agreement. Namely, it can change into the condition that the inner circumference end face of an insulating light-shielding film and the peripheral face of the electrode material 41 with which it fills up in opening touch. It is because the light-shielding film has insulation, so the problem of parasitic capacitance increasing does not arise even if it contacts a wiring metal.
[0100] Also with the thickness of the interlayer insulation film between a light-shielding film and wiring, it is made 400nm or less.
[0101] In the reflective mold liquid crystal display by the gestalt of this operation, since the insulating light-shielding film was used as a light-shielding film, intermediate opening can be plugged up completely and the light which entered from the isolation region of a reflector can prevent the thing to a lower field to leak.
[0102] The following results are obtained as one using the liquid crystal display by the gestalt of this operation of effectiveness. The optical incidence reinforcement in a liquid crystal loading condition was measured about it being green (it

centering on the wavelength of 540nm). When optical green incidence reinforcement was 2.3 W/cm2, the 120mV voltage drop had arisen in the condition that there is no light-shielding film, by setting an one-frame period to 8.3msec(s). On the other hand, when the light-shielding film structure of the liquid crystal display by the gestalt of this operation was used, the voltage drop decreased to 10mV. The value of the voltage drop of 10mV is an outstanding value which is extent which a problem does not produce at all practically, when it uses as a liquid crystal display.
[0103] In addition, in the gestalt of the above-mentioned operation, although premised on the p-type silicon semi-conductor substrate, a configuration with p mold well field on n mold silicon semi-conductor substrate may be used.
[0104] An insulating light-shielding film may be formed in a multilayer. Moreover, you may use combining a conductive light-shielding film and an insulating light-shielding film. An interlayer insulation film may be used also [light-shielding film / insulating].
[0105] As mentioned above, although this invention was explained in accordance with the gestalt of operation, this invention is not restricted to these. In addition, it is obvious ****** in this contractor for various modification, amelioration, combination, etc. to be possible.
[0106]
[Effect of the Invention] It will decrease, by the time the light which leaks from the clearance between reflectors reaches on a substrate. Therefore, deterioration of the image quality of the display device resulting from the leakage light to a semiconductor integrated circuit can be prevented.

[Translation done.]

DESCRIPTION OF DRAWINGS

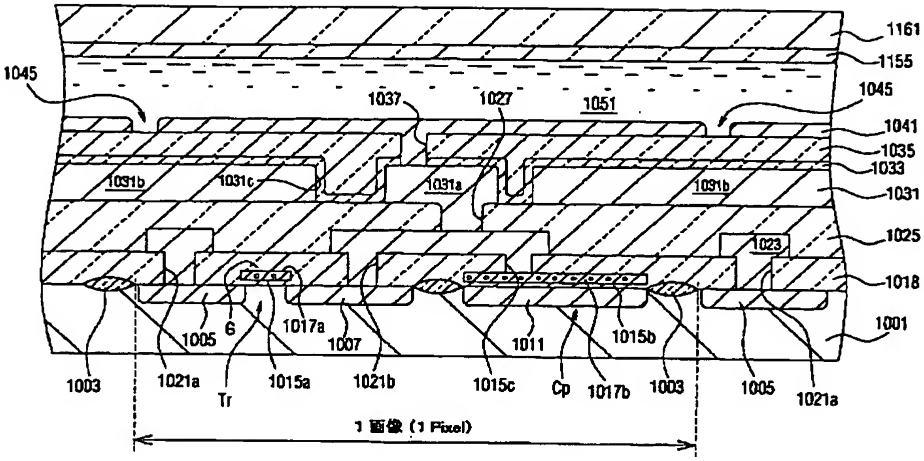
[Brief Description of the Drawings]
[Drawing 1] It is the sectional view showing the structure of a reflective mold liquid crystal display.
[Drawing 2] It is the top view showing the circuitry of a reflective mold liquid crystal display.
[Drawing 3] It is drawing showing the more detailed circuitry of a reflective mold liquid crystal display.
[Drawing 4] It is the top view showing the configuration of some reflective mold liquid crystal displays by the gestalt of operation of the 1st of this invention.
[Drawing 5] It is the top view showing the configuration of some reflective mold liquid crystal displays by the gestalt of operation of the 1st of this invention.
[Drawing 6] It is the top view showing the configuration of some reflective mold liquid crystal displays by the gestalt of operation of the 1st of this invention.
[Drawing 7] Drawing 7 (A) is the sectional view of the reflective mold liquid crystal display by the gestalt of operation of the 1st of this invention, and is a VIIa-VIIa' line sectional view from drawing 4 to 6. Drawing 7 (B) is the principle Fig. showing the course of the leakage light from the clearance between the reflectors in the case of the structure of drawing 7 (A), and is drawing showing the course of the light when combining and not having a light-shielding film.
[Drawing 8] It is the sectional view showing the structure of the reflective mold liquid crystal display twisted for being based on the 1st modification of the gestalt of the 1st operation.
[Drawing 9] It is the sectional view showing the structure of the reflective mold liquid crystal display by the 2nd modification of the gestalt of the 1st operation.
[Drawing 10] It is the sectional view showing the structure of the reflective mold liquid crystal display by the 3rd modification of the gestalt of the 1st operation.
[Drawing 11] It is the sectional view showing the structure of the reflective mold liquid crystal display by the gestalt of operation of the 2nd of this invention.
[Drawing 12] It is the sectional view showing the structure of the reflective mold liquid crystal display by the 1st modification of the gestalt of operation of the 2nd of this invention.
[Drawing 13] It is the sectional view showing the structure of the reflective mold liquid crystal display by the 2nd modification of the gestalt of operation of the 2nd of this invention.
[Drawing 14] It is the sectional view showing the structure of the reflective mold liquid crystal display by the gestalt of operation of the 3rd of this invention.
[Drawing 15] Drawing 15 (A) and drawing 15 (B) are drawings showing the effect of the leak light about the analog input electrical-potential-difference dependency of the pixel maintenance electrical potential difference in a reflective mold liquid crystal display.

[Description of Notations]
1 P-type Silicon Semi-conductor Substrate
Tr Transistor
Cp Storage capacitance
3 Component Detached Core
5 N Mold Impurity Layer
7 N Mold Impurity Layer
11 N Mold Impurity Layer
17a, 17b Polycrystalline silicon layer
18 Interlayer Insulation Film
G Gate electrode
S Source
D Drain
21a, 21b, 21c Opening
23 1st Wiring (1M)
23a The 1st wiring layer [1st]
23b The 2nd wiring layer [1st]
25 2nd Interlayer Insulation Film
27 Opening
30 Band-like Isolation Region
31 2nd Wiring (2M)
31a The 1st wiring layer [2nd]
31b The 2nd wiring layer [2nd]
35 3rd Interlayer Insulation Film
37 4th Interlayer Insulation Film
38 Conductive Light-shielding Film
38' Insulating light-shielding film
38a Opening
39 5th Interlayer Insulation Film
40 Contact Hole
41 3rd Wiring Layer (3M)
43 Isolation Region
RE Reflector
55 Common Electrode
61 Glass Substrate

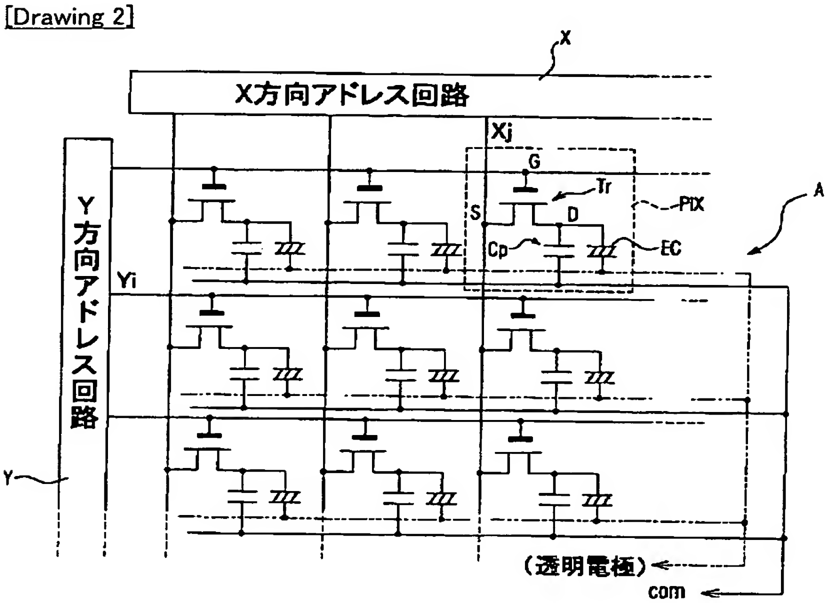
[Translation done.]

DRAWINGS

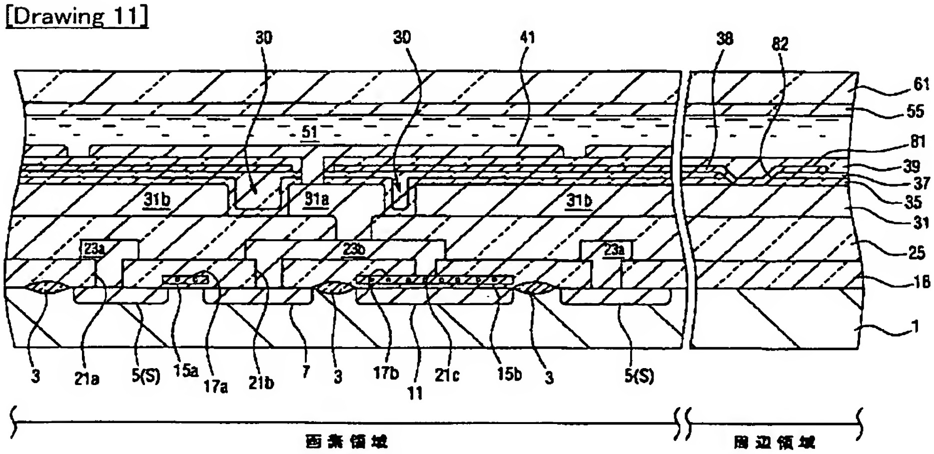
[Drawing 1]



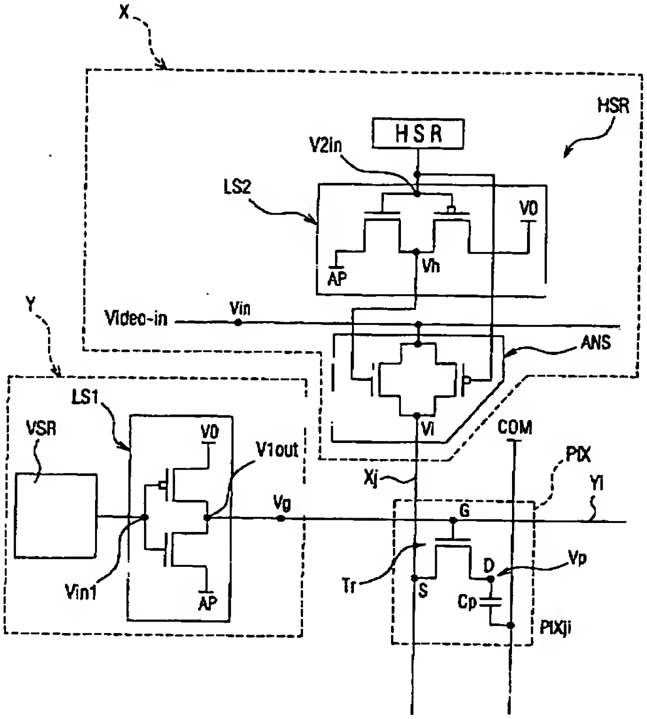
[Drawing 2]



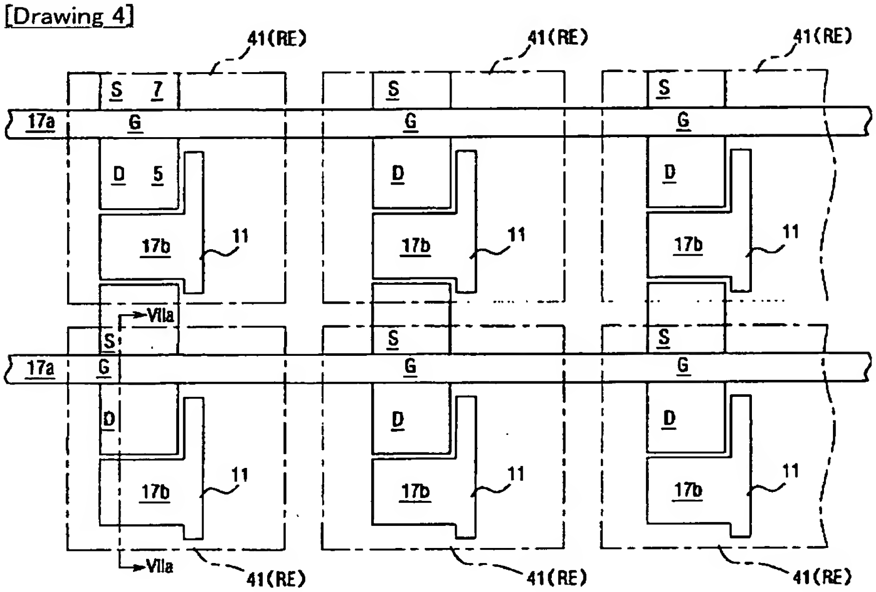
[Drawing 11]



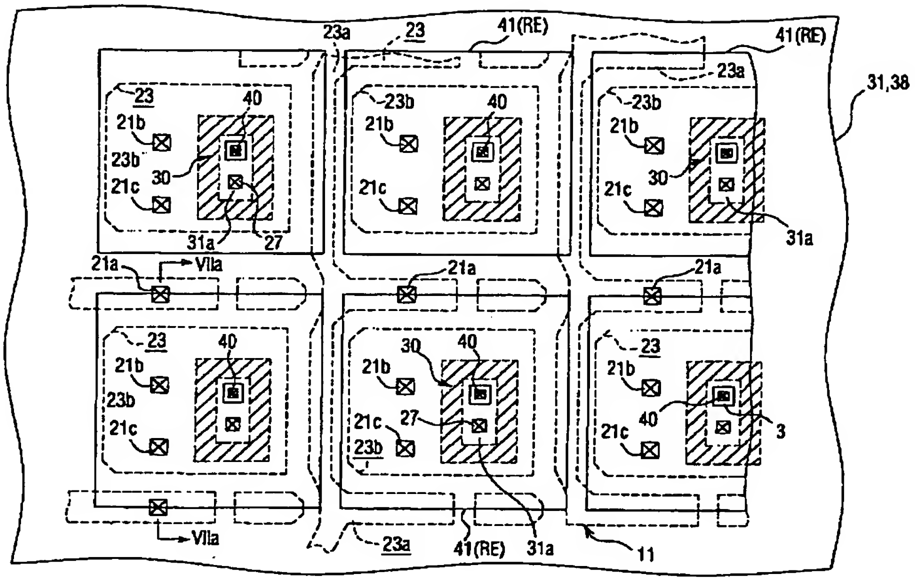
[Drawing 3]



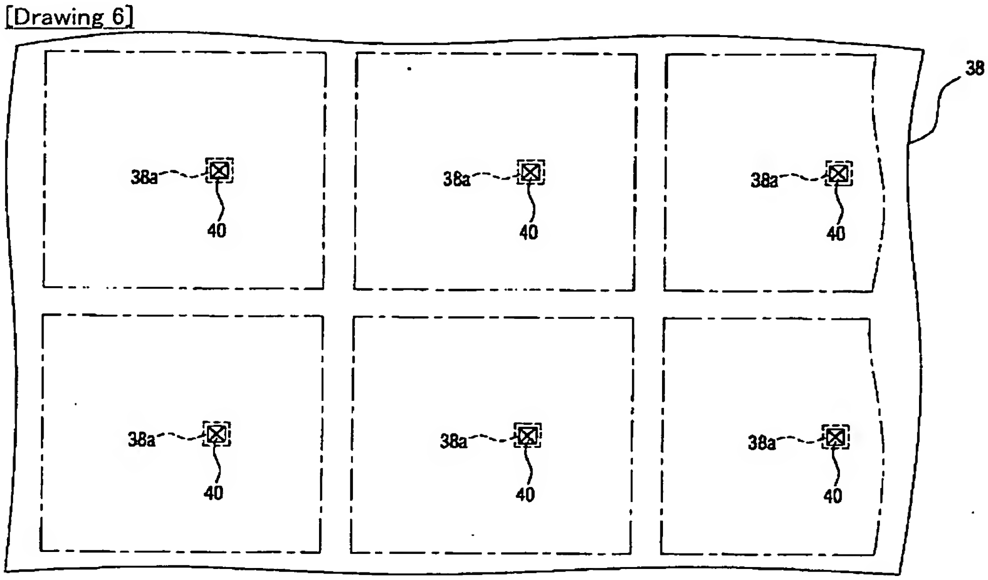
[Drawing 4]



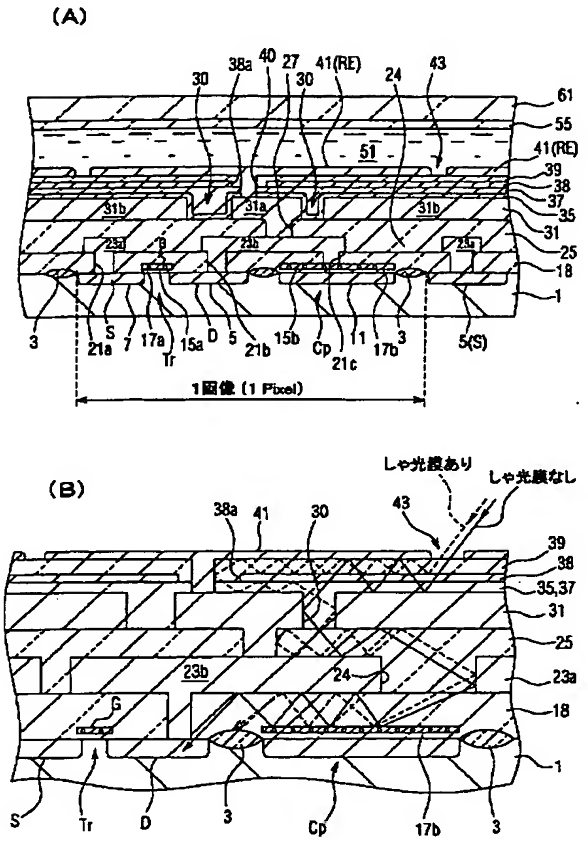
[Drawing 5]



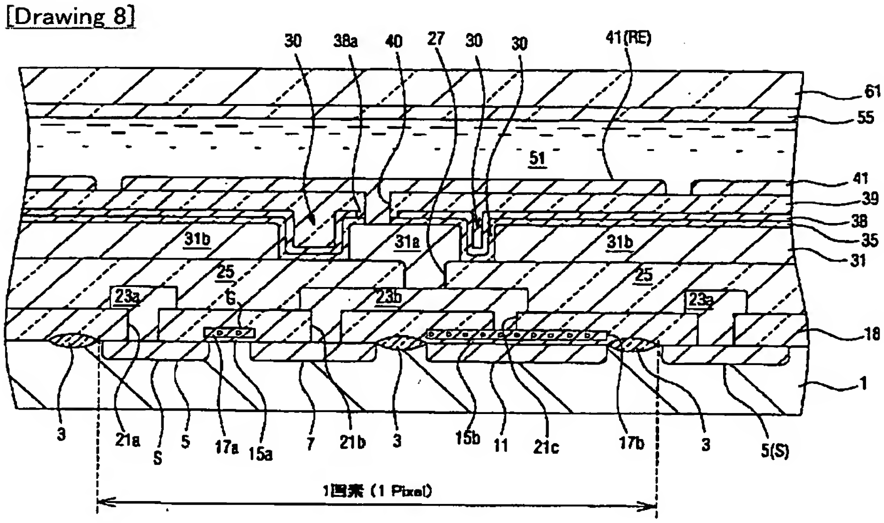
[Drawing 6]



[Drawing 7]

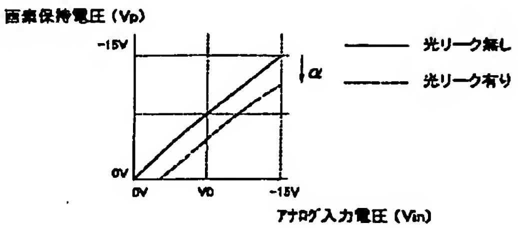


[Drawing 8]

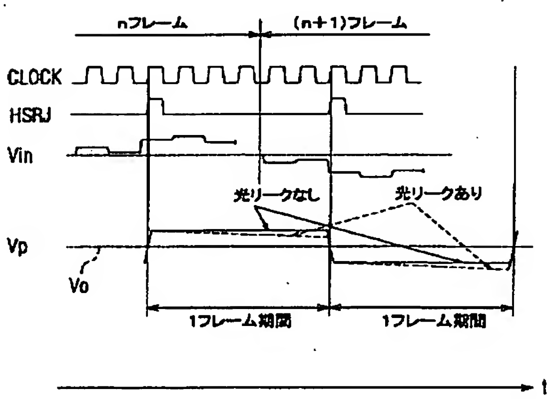


[Drawing 15]

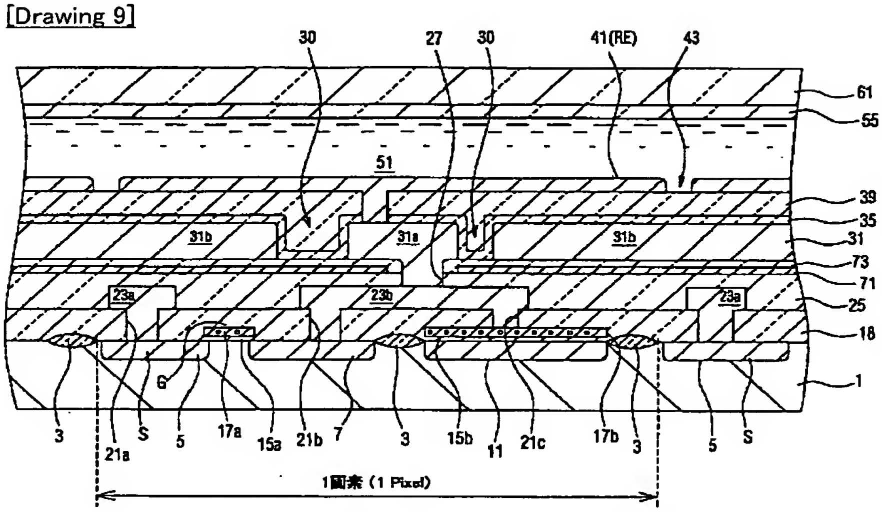
(A)



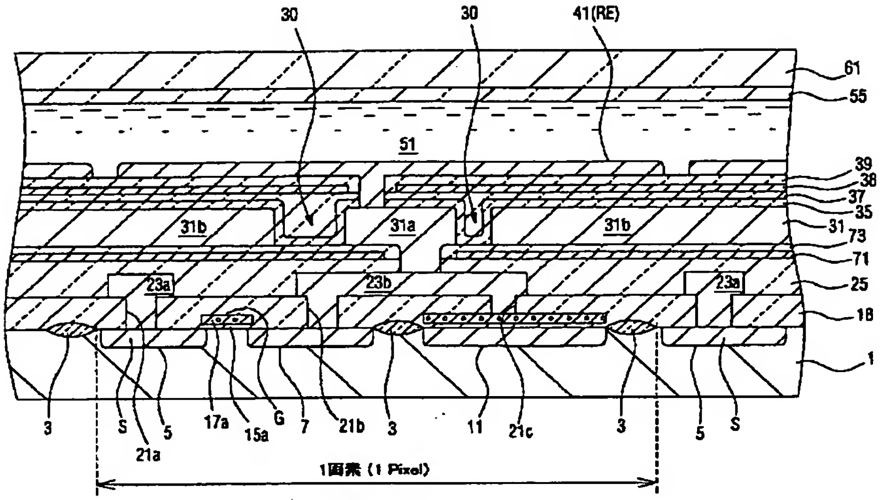
(B)



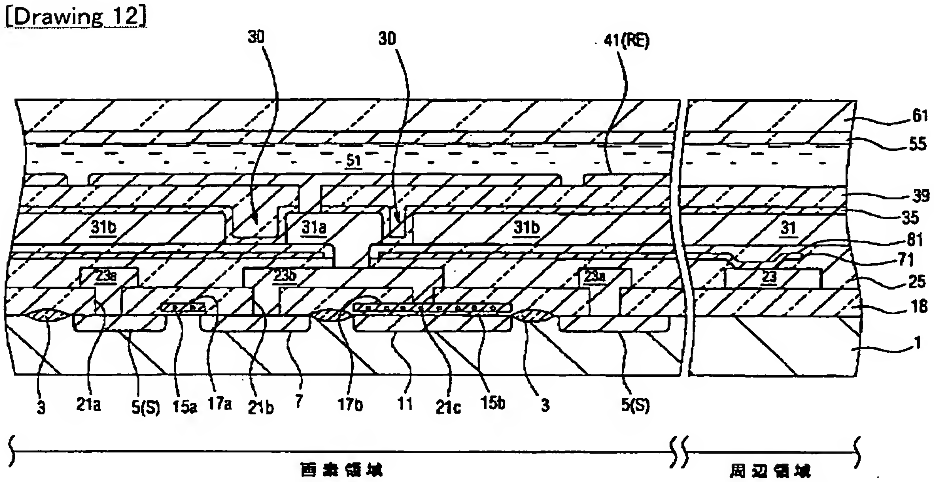
[Drawing 9]



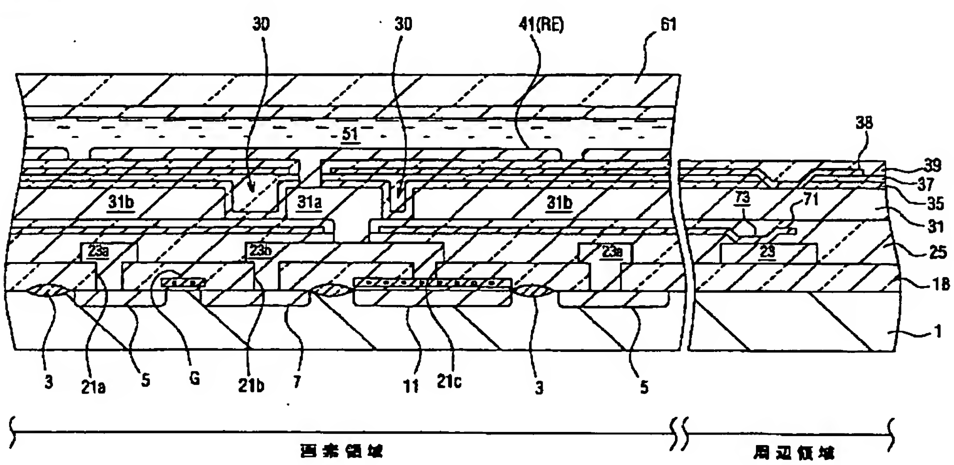
[Drawing 10]



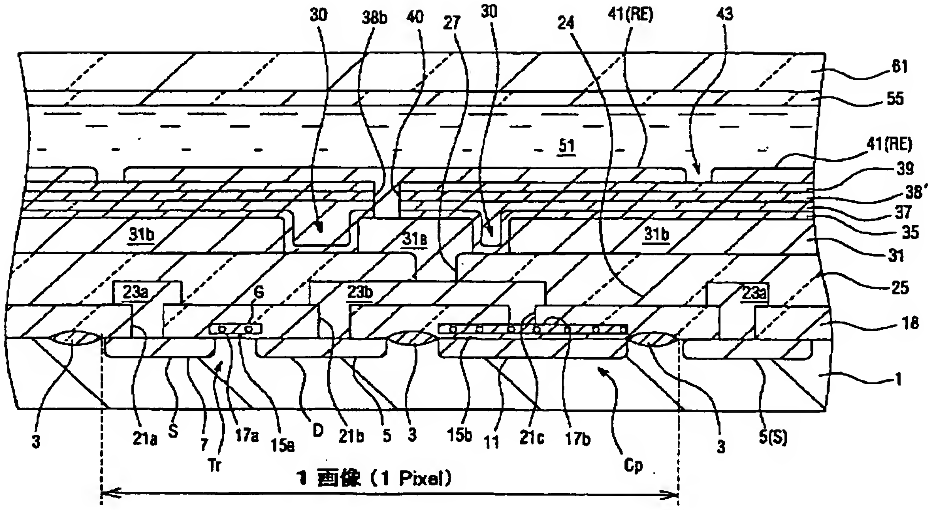
[Drawing 12]



[Drawing 13]



[Drawing 14]



[Translation done.]